

ENERGIC Plus



PROGRAMMABLE HIGH FREQUENCY CHARGER **CBC** USER'S MANUAL

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1. INTRODUCTION

This manual contains instructions and suggestions for the users of *Energic plus CBC* battery chargers. Before to install, use or repair the charger, it's necessary to read and understand this manual completely.

It's recommended to keep the manual in good condition for all the lifetime of the charger. It should be kept in a dry and clean place, always available to the users.

Throughout this manual, the following special annotations have been used to indicate important information.

WARNING !

Gives important information regarding possible personal injury

CAUTION !

Gives important information regarding possible equipment damage

NOTE

Gives additional information and tips concerning important procedures and features of the charger

RESPONSIBILITY DISCLAIMER

The manufacturer of the *Energic plus CBC* battery charger will not be responsible for damages and/or injuries caused by the charger in these situations:

- The charger is not installed properly by a qualified electrician;
- Maintenance operations are not done by a qualified electrician;
- The charger is not used according to the instructions included in this manual;
- The charger is not connected to the correct input supply (see data label on the box);
- The battery is damaged during the charge;
- The charger has been modified without the authorization of the manufacturer;
- Non-original spare parts are used in the charger;
- Wrong spare parts are used in the charger.

2. SAFETY INSTRUCTIONS AND WARNINGS

GENERAL

Battery chargers can cause injury or death, or damage to other equipment or property, if the user does not strictly observe all safety rules and take precautionary actions.

Safe practices must be learned through study and training before using this equipment.

Only qualified personnel should install, use, or service this battery charger.

SHOCK PREVENTION

Bare conductors, or terminals in the output circuit, or ungrounded, electrically-live equipments can fatally shock a person. To protect against shock, have competent electrician verify that the equipment is adequately grounded and learn what terminals and parts are electrically HOT.

The body's electrical resistance is decreased when wet, permitting dangerous current to flow through the body. Do not work in damp area without being extremely careful. Stand on dry rubber mat or dry wood and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry.

INSTALLATION AND GROUNDING – Electrical equipment must be installed and maintained in accordance with all the applicable national and local codes.

A power disconnect switch must be located at the equipment. Check the data label for voltage and phase requirements. If only 3-phase power is available, connect single-phase equipment to **ONLY TWO WIRES** of the 3-phase line.

DO NOT CONNECT the equipment grounding conductor to the third live wire of the 3-phase line as this makes the equipment frame electrically HOT, which can cause a fatal shock.

If a grounding conductor is part of the power supply cable, be sure to connect it to a properly grounded switch box or building ground. If not part of the supply cable, use a separate grounding conductor. Don't remove a ground prong from any plug. Use correct mating receptacles. Check ground for electrical continuity before using equipment.

The grounding conductor must be of a size equal to or larger than the size recommended by Code or this manual.

CHARGING LEADS – Inspect leads often for damage to the insulation. Replace or repair cracked or worn leads immediately. Use leads having sufficient capacity to carry the operating current without overheating.

BATTERY TERMINALS – Do not touch battery terminals while equipment is operating.

SERVICE AND MAINTENANCE – Shut OFF all power at the disconnect switch or line breaker **BEFORE** inspecting, adjusting, or servicing the equipment. Lock switch OPEN (or remove line fuses) so that the power cannot be turned ON accidentally.

Disconnect power to equipment if it is to be left unattended or out of service.

Disconnect battery from charger.

Measure voltage on capacitors and, if there is any voltage reading, wait 5 minutes before to proceed.

Keep inside parts clean and dry. Dirt and/or moisture can cause insulation failure. This failure can result in high voltage at the charger output.

BURN AND BODILY INJURY PREVENTION

The battery produces very high currents when short circuited, and will burn the skin severely if in contact with any metal conductor that is carrying this current.

Do not permit rings on fingers to come in contact with battery terminals or the cell connectors on top of the battery.

Battery acid is very corrosive. Always wear correct eye and body protection when near batteries.

FIRE AND EXPLOSION PREVENTION

When batteries are being recharged, they generate hydrogen gas that is explosive in certain concentrations in air (the flammability or explosive limits are 4.1% to 72% hydrogen in air). The spark-retarding vents help slow the rate of release of hydrogen, but the escaping hydrogen may form an explosive atmosphere around the battery if ventilation is poor.

The ventilation system should be designed to provide an adequate amount of fresh air for the number of batteries being charged. This is essential to prevent an explosion.

Always keep sparks, flames, burning cigarettes, and other sources of ignition away from the battery recharging area. Do not break "live" circuits at the terminals of batteries. Do not lay tools or anything that is metallic on top of any battery.

To prevent arcing and burning of the connector contacts, be sure the charger is OFF before connecting or disconnecting the battery. The digital display must be completely OFF.

MEDICAL AND FIRST AID TREATMENT

First aid facilities and a qualified first aid person should be available for each shift for immediate treatment of electrical shock victims.

EMERGENCY FIRST AID: Call physician and ambulance immediately and use First Aid techniques recommended by the American Red Cross.

DANGER: ELECTRICAL SHOCK CAN BE FATAL.

If person is unconscious and electric shock is suspected, do not touch person if he or she is in contact with charging equipment, battery, charging leads, or other live electrical parts. Disconnect power at wall switch and then use First Aid.

Dry wood, wooden broom, and other insulating material can be used to move cables, if necessary, away from person.

IF BREATHING IS DIFFICULT, give oxygen.

IF NOT BREATHING, BEGIN ARTIFICIAL BREATHING, such as mouth-to-mouth.

IF PULSE IS ABSENT, BEGIN ARTIFICIAL CIRCULATION, such as external heart massage.

In case of acid in the eyes, flush very well with clean water and obtain professional medical attention immediately.

EQUIPMENT WARNING LABELS

Inspect all precautionary labels on the equipment.

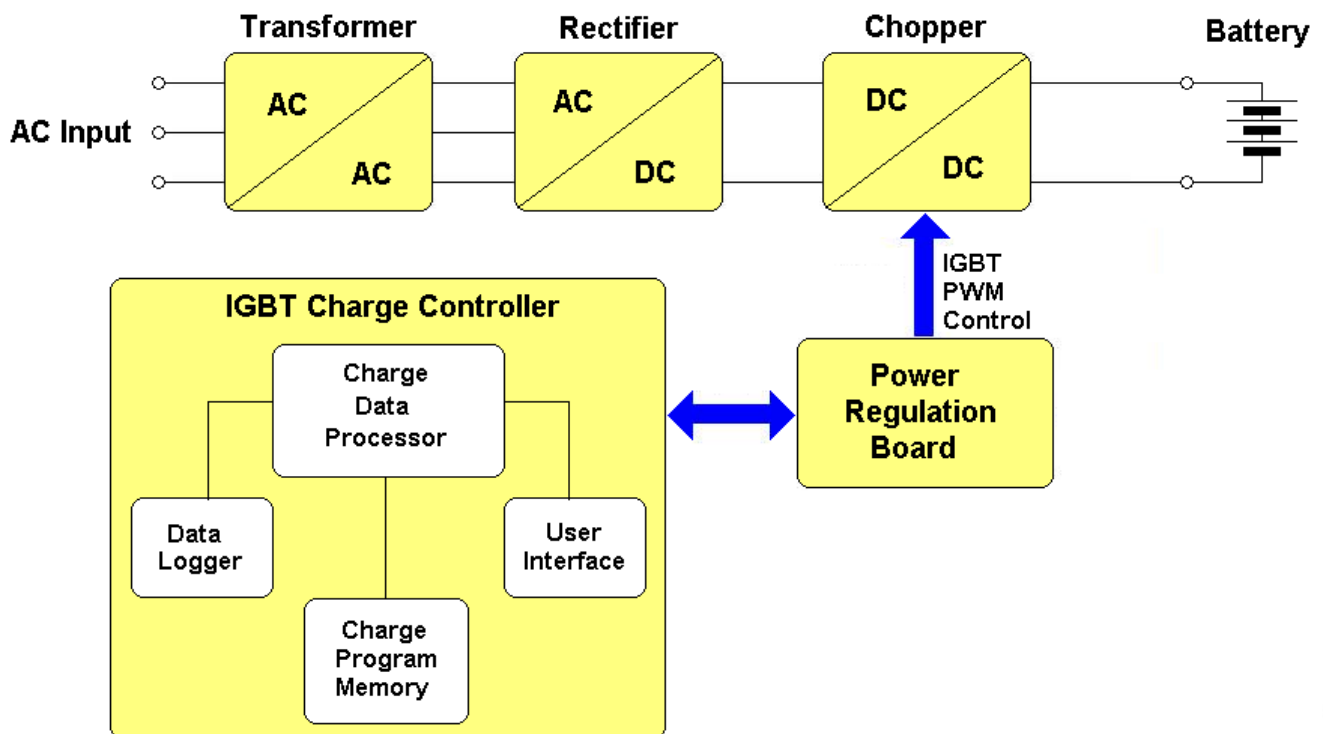
Order and replace all labels that cannot be easily read.

3. DESCRIPTION

The CBC is a high frequency IGBT battery charger of the latest generation. It combines outstanding electrical performances, complete programmability and real universal charging capability.

It features a complete, active protection system, which includes Reverse Polarity, Short Circuit, Overtemperature, Wrong Battery, Anti-Arcing, and more.

The electrical structure of the CBC is represented in the following block schematic.



The **TRANSFORMER** reduces the AC input voltage and provides electrical insulation between the input and the output of the charger. The **RECTIFIER** converts the AC output of the transformer to an unregulated DC voltage.

The **CHOPPER** (operating at high frequency), regulates the output voltage and current to the right values. The chopper has a negligible output ripple.

The **IGBT CHARGE CONTROLLER** is the main control unit of the CBC. It's a microprocessor based electronic board of the last generation, and it contains the **USER INTERFACE** (Display, LEDs and Keyboard), the **CHARGE PROGRAM MEMORY** (where all the programmed parameters are saved), the **DATA LOGGER** (where the charge history is saved) and the **CHARGE DATA PROCESSOR**, which manages the entire charge process.

The **POWER REGULATION BOARD** controls the operation of all the power components. It receives command signals from the IGBT CHARGE CONTROLLER, and it generates the high frequency PWM control signal for the IGBT.

The startup sequence, the thermal protection and the polarity protection of the charger are managed by the **POWER REGULATION BOARD**, which receives signals from several sensors that are located inside of the charger.

The four CBC models available (K5, K8, K10, K15) are all multivoltage (12 to 96 V) but have different power ratings, therefore they can give different maximum currents, depending on the voltage of the battery.

BATTERY VOLTAGES	MAXIMUM OUTPUT CURRENTS			
	K5	K8	K10	K15
12 V	120 A	200 A	200 A	200 A
24 V	120 A	200 A	200 A	200 A
36 V	120 A	150 A	180 A	200 A
48 V	120 A	120 A	150 A	200 A
72 V	80 A	80 A	110 A	160 A
80 V	70 A	70 A	100 A	150 A
96 V	60 A	60 A	80 A	120 A

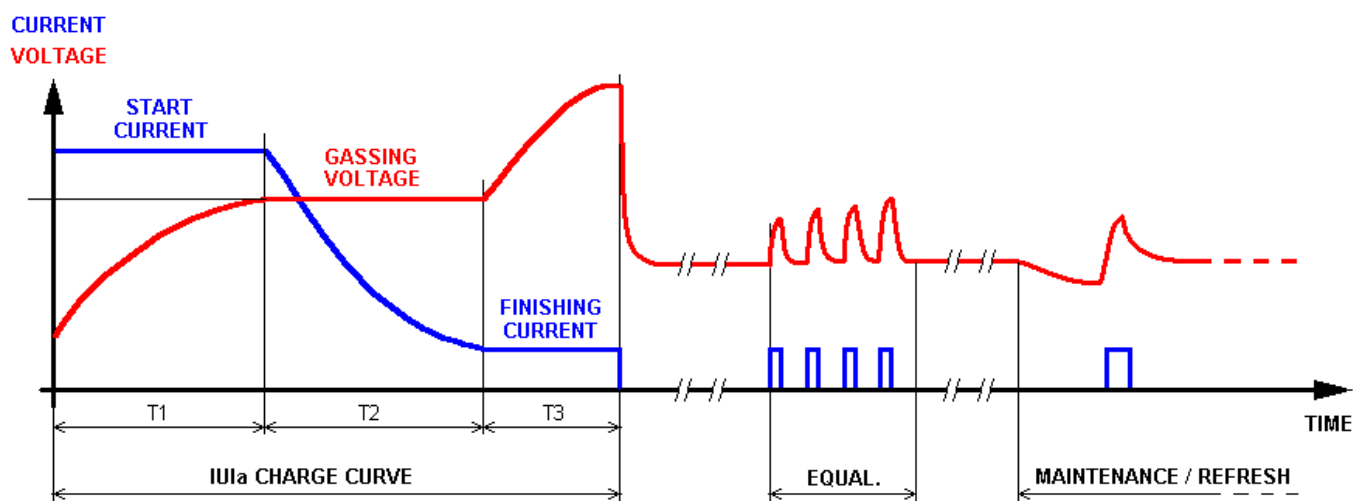
The control panel is complete and easy to use: four coloured LEDs indicate the state of the charge, while a 2x20 character dot matrix display gives complete information and error messages in plain text (multilingual).

A three button flat membrane keyboard is used for programming and data review.

A unique feature of the CBC is the ASSISTED PROGRAMMATION of the charge curve: the user just needs to enter the basic info about the battery (Type, Voltage, Capacity) and the time available for charging it (from 6 to 24 hours). The CBC charge controller calculates automatically the ideal charge curve for the given parameters.

While the programming and operation of the CBC can be totally assisted and automatic, expert users have the possibility to adjust the charge parameters and options without limitations (Gassing Voltage, Equalization Mode, Refresh Mode, Language and other).

The charge curve of the CBC is based on the "IUIa" (or "IEI") system, but instead of applying a pre-defined charge curve to the battery, the IGBT CHARGE CONTROLLER calculates all the curve parameters (Currents, Voltage Limits, Maximum Times) according with the Battery Data and User Programming. Moreover, the curve is dynamically adjusted while the charge is in progress, depending on the actual status of the battery.



4. INSTALLATION

Conditions of use:

- Operating /Storage temperature: 5°C to 45°C
- Relative humidity: less than 75%

WARNING !

The charger can be installed by qualified personnel only!
To avoid the risk of injuries, the user is not allowed to open the cabinet.
Always refer to qualified electricians for installation and service operations.

WARNING !

To prevent fire or shock hazard, do not expose the charger to rain or moisture.
Do not use the e charger in presence of flammable gas, because it can generate sparks!
Do not install the charger near flammable materials.

WARNING !

To reduce the risk of fire, the charger must be installed on a
floor of non-combustible material.
If this is not possible, a floor plate of at least 1,6mm steel extended
at least 150mm beyond the charger on all sides must be installed.

CAUTION !

Before to install the charger:
Check that the charger input voltage (V) is identical to your AC power supply voltage.
Check that the charger max input power (KVA) is available from your AC power supply.

CAUTION !

Allow adequate air circulation to prevent internal heat buildup.
Do not place the unit near materials that may block the ventilation slots.
Do not install the unit near heat sources such as radiators or air ducts, or in a place
subject to direct sunlight, excessive dust, mechanical vibration or shock.

GROUNDING AND LINE CONNECTION**WARNING !**

The cabinet of the battery charger must be properly grounded to protect personnel against hazard of electrical shock in case of fault on the charger! The grounding conductor must have a current carrying capacity equal or higher than the current carrying capacity of the AC-input wires.

If the charger is to be connected to the AC power supply with a flexible jacketed cable, one having a separate grounding conductor should be used.

If, for any reason, an input cable which does not include a grounding conductor is used, the equipment must be grounded with separate conductor. Minimum size and color coding requirements must be in accordance with any applicable national or local code.

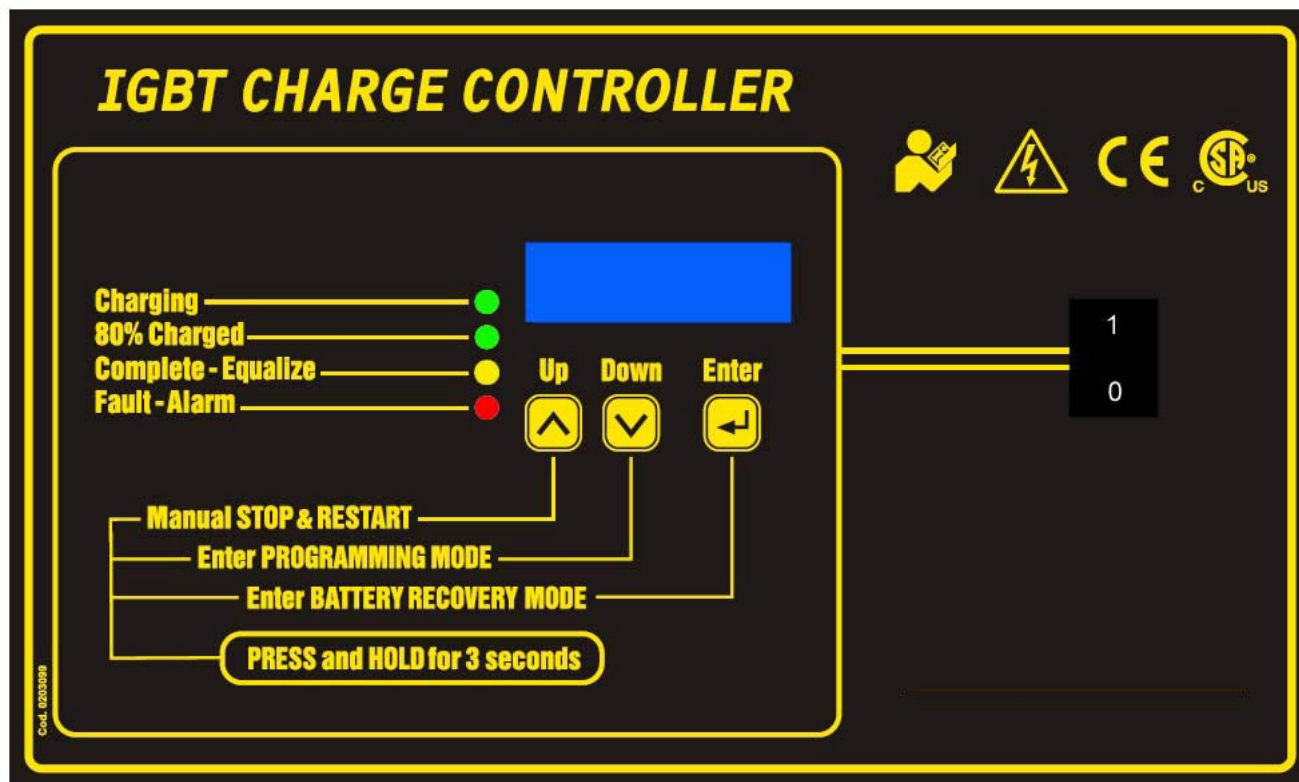
PROCEDURE

- Read on the data label the AC current value corresponding to the line voltage to which charger is to be connected. Using that current value, select the proper fuses, disconnect switch and power cable sizes, according with any applicable national or local code.
- Check that the charger is disconnected from AC input and battery;
- Open the cabinet;
- Mount the input cable and connect the four power conductors (three phase + ground) to the terminal blocks;
- Close the cabinet;
- With disconnect switch on AC input power line on position "OFF" or "OPEN", connect the power cable coming from the charger to the switch and, then, install the fuses in the switch.

NOTE

CBC units for the European market have the AC-input cable already mounted. In this case, only the input plug has to be mounted at the installation of the charger, therefore it's not necessary to open the cabinet at the installation.

5. OPERATION



PRELIMINARY CHECKS

- Inspect the charger completely for loose screws, electrical connections or other damages;
- Check that all the ventilation slots are not obstructed to assure proper air flow;
- Make sure that the charger is installed as instructed in this manual and in accordance with any applicable national or local Code.

PROGRAMMATION

CAUTION !

It's necessary to program the charger **BEFORE** to connect the battery.
If the programmation is not made properly, the battery can be **DAMAGED**.

The CBC can be programmed through the User Interface. The programmation is password protected, and the procedure is quick and easy.

Before to start the programmation, it's necessary to collect the relevant battery data:

- Battery nominal voltage (V)
- Battery type (Lead-Acid or GEL)
- Battery capacity (Ah)

PROGRAMMATION PROCEDURE.

- Turn on the charger, by moving the main switch to position "1".
The digital display shows Charger Model and Software Version. Then, it shows the message:

NO BATTERY
SYSTEM READY

- Press button DOWN, and keep it pressed for 3 seconds.
The display shows the message:

PASSWORD

- Press the buttons in this exact sequence: UP, DOWN, UP, DOWN, UP.
The display shows the message:

OPERATOR MODE

- Press button UP to scroll between the charge parameters, until the display shows:

BATTERY VOLTAGE
24

In order to modify this parameter, press button ENTER and keep it pressed for 3 seconds. This will enable the EDIT MODE: a cursor will blink on the voltage value. Select the battery voltage using the buttons UP/DOWN. When the correct battery voltage is displayed, press ENTER and keep pressed for 3 seconds, in order to SAVE the modified value and exit EDIT MODE.

- Press button UP to proceed to the next parameters.

The procedure to modify a parameter is the same for all the programmable parameters:

- Press ENTER and keep it pressed for 3 seconds, to enter EDIT MODE;
- Use UP / DOWN to modify the value;
- Press ENTER and keep it pressed for 3 seconds, to SAVE the value.

- The next parameters to be programmed are:

Battery TYPE	[Pb, GEL]
Battery CAPACITY	[50 to 2000 Ah]
TIME AVAILABLE FOR CHARGE	[6 to 24 hours]

BATTERY TYPE
Pb

BATTERY CAPACITY
500 Ah

TIME AVAILABLE
10

When the BASIC parameters have been programmed (BATTERY TYPE, VOLTAGE, CAPACITY, and TIME AVAILABLE FOR CHARGE), the IGBT CHARGE CONTROLLER is able to calculate the basic charge curve, and charger is ready to charge the battery.

Anyway it's also possible to continue with the programming of the OPTIONAL PARAMETERS (Gassing Voltage, Equalization / Refresh Mode).

- Press button UP to REVIEW the CALCULATED parameters.
It's now possible to review the charge parameters (START CURRENT I1, FINISHING CURRENT I2, MAXIMUM TIMES for each charge period T1, T2, T3).

NOTE

The CALCULATED PARAMETERS can't be modified directly by the user.

- When the programming is complete, press buttons UP and DOWN contemporarily to exit the programming and return to NORMAL MODE.
When the buttons are released, the display shows:



NORMAL MODE

- Turn off the charger, by moving the main switch to position “0”.
- Turn on the charger, by moving the main switch to position “1”.
The digital display shows Charger Model and Software Version. Then, it shows the message:



NO BATTERY
SYSTEM READY

BATTERY CONNECTION, VOLTAGE CHECK AND AUTOSTART**CAUTION !**

ENERGIC Plus CBC chargers are programmed to do a complete cycle of charge automatically, however it's always recommended to survey the operations, especially when the battery is connected to the charger for more than 12 hours.

- Turn on the charger.
The display shows the message:



NO BATTERY
SYSTEM READY

- Connect the battery to the charger, using an adequate connector.
The IGBT Charge Controller verifies the battery voltage and polarity, and the display shows the message:



BATTERY CONNECTED
START CHARGE

- If the battery voltage is below the minimum threshold of 1,62 V/cell, the charger will not start, and the display will show the error message "BLoW".

Press button ENTER and keep it pressed for 3 seconds to start a RECOVERY – DESULPHATION CYCLE. The display will show the message:



DESULPHATION

The RECOVERY – DESULPHATION cycle is completely automatic, and it may take up to 4 hours. At the completion of the cycle, the battery voltage is verified again, and if it's high enough, a normal charge cycle starts.

- If the battery voltage is higher than the maximum threshold of 2,60 V/cell, the charger will not start, and the display will show the error message "BHigh".
In this case, it's impossible to start the charge, and it's recommended to verify that the programmed battery voltage is correct.
- If the battery voltage is between the minimum and maximum thresholds, the charger will turn on automatically after 5 seconds.

The output current will ramp slowly to the right value, and the display will show the charge parameters (BATTERY VOLTAGE, CAPACITY RETURNED TO THE BATTERY, CHARGE CURRENT, CHARGE TIME), in a visualization of this type:



37.1 V 1 Ah
150 A 00:01 t

CHARGE CYCLE

While the charge is in progress, the charge parameters continuously showed on the display.

The LEDs indicate the charge status:

- Period T1(Const. I): the LED "Charging" blinks.
- Period T2 (Const. V): the LEDs "Charging" and "80% Charged" blink simultaneously.
- Period T3 (Const. I): the LED "80% Charged" remains on, while the LEDs "Charging" and "Complete-Equalize" blink simultaneously.

In any moment, it's possible to scroll between the menu parameters, by pressing the buttons UP and DOWN.

A dedicated menu page indicates the charge status, with a visualization of this type:



CURRENT I1

SAFETY TIMERS – EMERGENCY STOP

The IGBT CHARGE CONTROLLER calculates maximum safety times for each charge periods, according with the programmed data.

If the battery doesn't reach the gassing voltage within the calculated time (T1MAX) the, the charge is terminated by the Emergency timer.

The display will show the error message "T1max", and the buzzer will give audible alarm and the LED "Fault – Alarm" will light on.

If this error message appear, it's recommended to verify the battery status and the programming of the CBC.

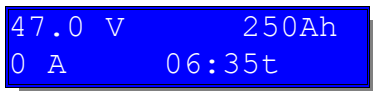
AUTOMATIC AND MANUAL CHARGE TERMINATION

WARNING !

**DON'T disconnect the battery from the charger while it is being charged.
ARCING AND BURNING OF CONNECTORS OR BATTERY EXPLOSION MAY RESULT!**

- AUTOMATIC CHARGE TERMINATION:**

When the charge has been normally completed, the power stage turns off automatically, and it's possible to disconnect the battery. The LED "Complete – Equalize" turns on and the display continues to show the last charge parameters:



47.0 V 250Ah
0 A 06:35t

- While the charge is in progress, it's possible to suspend it in any moment, by pressing the button UP and keeping it pressed for 3 seconds.

The charge current will reduced to zero and the display will show the message:



MANUAL STOP

At this point, it's possible to disconnect the battery.

EQUALIZATION**WARNING !**

**DON'T disconnect the battery from the charger while it is being charged.
ARCING AND BURNING OF CONNECTORS OR BATTERY EXPLOSION MAY RESULT!**

The EQUALIZATION function is useful to keep all the cells of the battery at the same voltage level, even after years of continuous work. When a battery is charged/discharged everyday, it's suggested to equalize it weekly.

The charger, after a normally completed charge cycle, will add 4 extra charges of 30 minutes, with 15 hours interval between each charge.

MAINTENANCE

The MAINTENANCE function is useful to keep the battery in perfect condition when it's not used for an undefined time (weeks, months, ...).

It is sufficient to leave the battery connected to the charger: the control board will keep the battery voltage under control and will activate the charger automatically when the voltage falls below a predefined minimum threshold.

NOTES

With this “voltage controlled” maintenance/refresh system, the battery will be kept in perfect condition for an undefined time, without any risk of undercharge or overcharge.

*If the battery is in ideal condition (no self-discharge) the refresh charge will never be activated.
If the battery is in bad condition (self-discharge is significant), the refresh charge will be often activated and the battery will be kept charged without problems.*

THERMAL PROTECTION – CHARGER

The CBC Power Regulation Board incorporates a thermal protection system, that may reduce the output current of the charger down to zero, in case of overheat of the charger power circuits.

When the temperature of the power circuits returns to a safe level, the output current of the charger returns to the normal value automatically.

THERMAL PROTECTION – BATTERY (OPTIONAL)

The CBC battery charger can be equipped with two types of optional temperature probes, for the protection of the battery.

THERMAL SWITCH

A submersible thermal switch can be connected to a dedicated terminal block, that is installed **ON REQUEST** inside of the unit, near the battery cable connections.

This thermal switch will suspend the charge if the battery temperature exceeds the trip value of the thermal switch.

Contact your dealer for more info.

TEMPERATURE PROBE NTC 100k

A NTC 100k can be connected to a dedicated terminal block, that is installed **ON REQUEST** inside of the unit, on the IGBT Charge Controller.

When the CBC is equipped with this type of thermal probe, it's possible to set the max temperature allowed for the battery directly on the charger control panel.

Contact your dealer for more info.

ANTI-ARC PROTECTION (OPTIONAL)

The CBC battery charger can be equipped with an ANTI-ARC protection system, that eliminates the risk of arcing between the connectors, in case of battery disconnection while the charge is in progress.

It's sufficient to add a loop circuit using two wires, and two auxiliary contacts on the charger and battery connectors.

The two wires of the loop circuit can be connected to a dedicated terminal block, that is installed **ON REQUEST** inside of the unit, near the battery cables connections.

Contact your dealer for more info.

STATS

At the end of each charge cycle, the IGBT CHARGE CONTROLLER saves the relevant charge data into the DATA LOGGER memory.

In any moment, it's possible to access the DATA LOGGER memory to review the saved data, by selecting the menu STATS with the UP/DOWN buttons and pushing ENTER.

Each record is visualized in this format:

```
N10  250Ah  36,1V  
E00  06:35t  47,0V
```

LINE 1

- Number of saved charge cycle (the last cycle has the highest number);
- Capacity returned to the battery;
- Battery voltage at the beginning of the charge.

LINE 2

- Charge Termination Code, see next paragraph;
- Total time of charge;
- Battery voltage at the end of the charge.

CHARGE TERMINATION CODE

Each record saved in the DATA LOGGER memory contains a Charge Termination Code, that gives a detailed description of the result of each cycle ended.

Each Charge Termination Code is composed by a letter and a number.

The letter indicate the reason why the charge ended, and it can be:

"T"	→	Charge completed normally
"B"	→	Battery Disconnected by User
"E"	→	Manual or Emergency Stop

If the charge is completed normally, the letter "T" can be followed by these numbers:

"T3"	→	Charge completed normally
"T23"	→	Charge completed normally, but constant voltage stage exceeded 3 hours.

If the Equalization has been performed, an additional letter "E" is added to the code:

"T3E"	→	Charge completed normally, equalization done
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If the battery has been disconnected while the charge was in progress, the letter “B” can be followed by these numbers:

“B00”	→	Battery disconnected immediately
“B01”	→	Battery disconnected during first stage (Constant Current I1)
“B02”	→	Battery disconnected during second stage (Constant Voltage V1)
“B03”	→	Battery disconnected during third stage (Constant Current I2)
“B07”	→	Thermal protection activated, and battery disconnected after restart

If an error occurred and the charge has been stopped in emergency condition, the letter “E” can be followed by these numbers:

“E01”	→	Charger stopped by user during first stage (Constant Current I1)
“E02”	→	Charger stopped by user during second stage (Constant Voltage V1)
“E03”	→	Charger stopped by user during third stage (Constant Current I2)
“E05”	→	Max time T1 exceeded – Gassing Voltage not reached
“E06”	→	Battery Voltage higher than 2,80 V/cell during the charge
“E07”	→	Thermal protection activated, and battery disconnected before restart

6. SPAREPARTS TABLE

Model	K5	K8	K10	K15
Power Transformer	0207205	0207205	0207210	0207215
Output inductor	0207305	0207310	0207310	0207310
Rectifier	0201863	0201863	0201943	0201945
Power stage	0100358	0100360	0100360	0100360
Fan	0204002	0204002	0204002	0204002
Aux transformer	0205572	0205572	0205572	0205572
Power Regulation Board	0205590	0205590	0205590	0205590
Digital control board	0206100	0206100	0206100	0206100
Input contactor	0202961	0202961	0202962	0202962
Output contactor	0203241	0203241	0203241	0203241
Output fuse	0201079	0201081	0201081	0201081
Front door	02032915	02032915	02032915	02032915
Right panel	02032985	02032985	02032985	02032985
Left panel	0203299	0203299	0203299	0203299
Rear panel	0203295	0203295	0203295	0203295
Top panel	0203296	0203296	0203296	0203296
Base	0203297	0203297	0203297	0203297

- END OF MANUAL -